

# ADVANCED AVIATION TECHNOLOGIES RELATED TO AVIATION CAPACITY IMPROVEMENTS

Prepared for:  
MTC

Prepared By:  
Don Crisp  
ATAC

February 23, 2007



# Overview

- ◆ Review advanced aviation systems & technologies that have potential to improve aviation capacity.
- ◆ Classify systems according to the time period when such systems may be ready for deployment (near-term, mid-term, and far-term).
- ◆ Identify those systems that could provide potential capacity benefits at SFO on closely spaced parallel runways and qualitatively classify these potential gains (none, low, medium, or high).

# San Francisco International Airport





# Capacity Issues at SFO

- ◆ Of the 35 OEP airports, SFO identified as a “pacing airport”.
  - Unique runway configuration with 2 east-west parallel runways (runways 10R/28L and 10L/28R) and 2 north-south parallel runways (runways 01L/19R and 01R/19L) which cross.
  - Single arrival runway operation during bad weather conditions
  - Additional set of separation requirements on arriving sets of aircraft which cannot be overcome by technology.
- ◆ En Route Airspace
  - Today's Problem – Ability to deliver aircraft demand to the Terminal Environment
  - Technologies/systems identified as providing possible solutions
    - ◆ ERAM, DRVSM, ATOPS, TFM-M, FMS, WakeVAS, CTAS, ADS-B
- ◆ Terminal Airspace – (SFO specific)
  - Today's Problem – Ability to deliver aircraft demand to two closely spaced parallel runways in all weather conditions
  - Tools that have been identified as providing possible capacity improvements
    - ◆ RNP/RNAV, CDTI/CAVS, WakeVAS, ADS-B, SOIA/PRM

# Aviation Programs/Systems

- ◆ ERAM - En Route Automation Modernization
- ◆ SWIM - System Wide Information Management
- ◆ TFM-M - Traffic Flow Management Modernization
- ◆ RVSM - Reduced Vertical Separation Minimum
- ◆ TAMR - Terminal Automation Modernization Replacement
- ◆ ATOP - Advanced Technologies & Oceanic Procedures

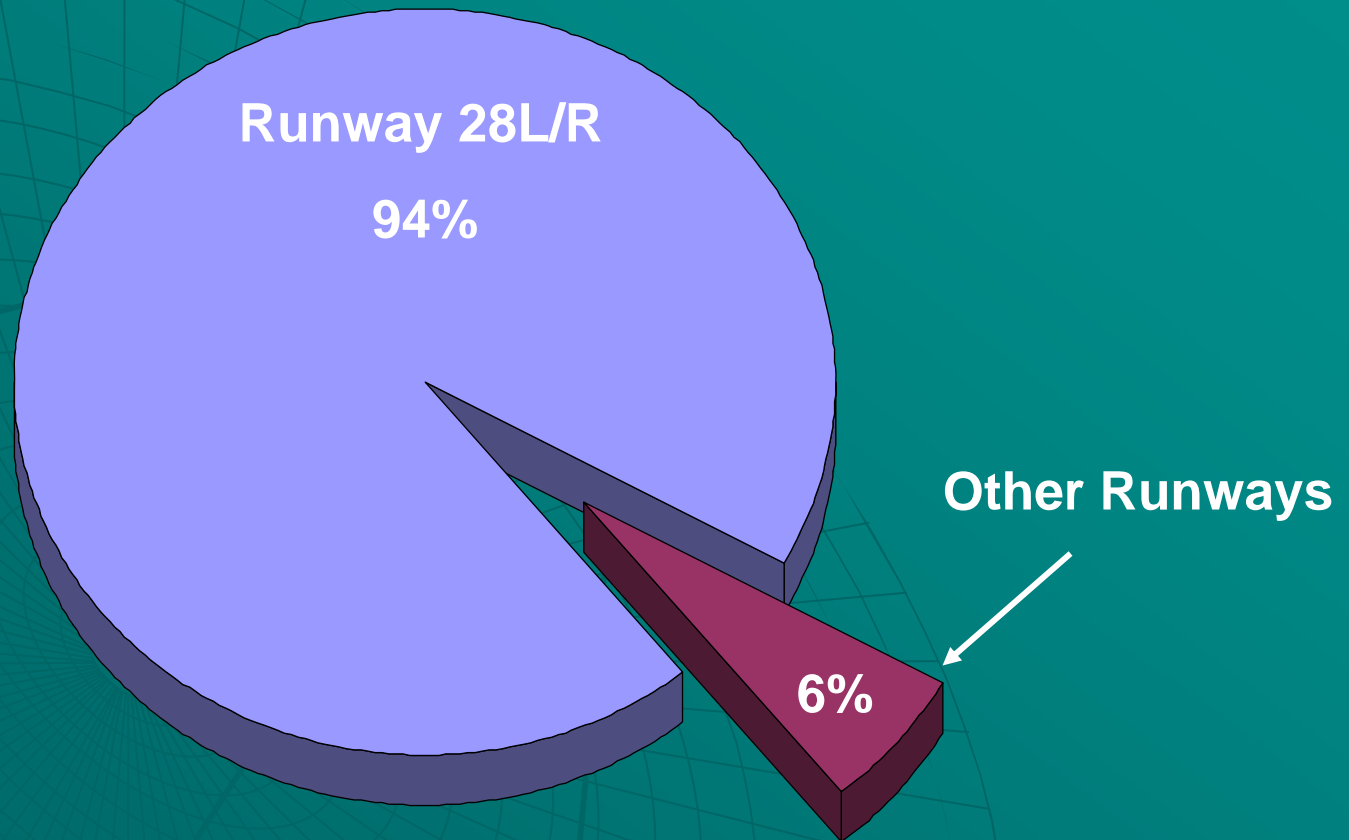
# Aviation Technologies

- GPS - Global Positioning System
- WAAS - Wide Area Augmentation System
- LAAS - Local Area Augmentation System
- ADS-B - Automatic Dependent Surveillance – Broadcast
- CTAS - Center/TRACON Advisory System
- FMS - Flight Management Systems
- URET - User Request Evaluation Tool
- RNP - Required Navigation Performance
- CDTI - Cockpit Display of Traffic Information/CAVS - Assisted Visual System
- WakeVAS - Wake Vortex Advisory System
- SOIA/PRM - Enhanced Simultaneous Offset Instrument Approach

# Current and Planned Status – Benefits to SFO

Technology	Current Status	Planning Horizon	Capacity Benefit to SFIA	Remarks
RNP	Deployed	Near/Mid Term	Moderate	Satellite-based technology (GPS, INS, and/or LAAS) which would provide a replacement for the ILS systems currently in use. (RNP 0.3 for 28R in effect)
LAAS	R&D	Far Term	Low	GPS-based augmentation system that has the potential to provide multiple precision (down to CAT III) approach capabilities to runways within the LAAS coverage area. Use in conjunction with RNP technology.
ADS-B	Partially Deployed	Near/Mid Term	Low	Satellite-based technology to be used by ATC and pilots for separation purposes. Replacement for current FAA radar systems. By itself will not provide SFIA with solutions to the problems associated with closely-spaced parallel runways.
CDTI/CAVS	R&D	Mid/Far Term	High	Cockpit technology providing the pilot with assisted visual capabilities to conduct visual approaches with less than visual weather conditions (stratus layer). Coupled with RNP and ADS-B technology would replace SOIA/PRM procedures.
WakeVAS	R&D	Far Term	Moderate	Technology to provide ATC and pilots with real-time wake vortex behavior. Could increase airport capacity by reducing aircraft spacing.
SOIA/PRM	Deployed	Near/Mid Term	Moderate	Technology to up-grade the existing system by providing wake vortex enhancements which could reduce current approach ceiling minimums to 1,400 or 1,600 feet from the current 2,100 feet.

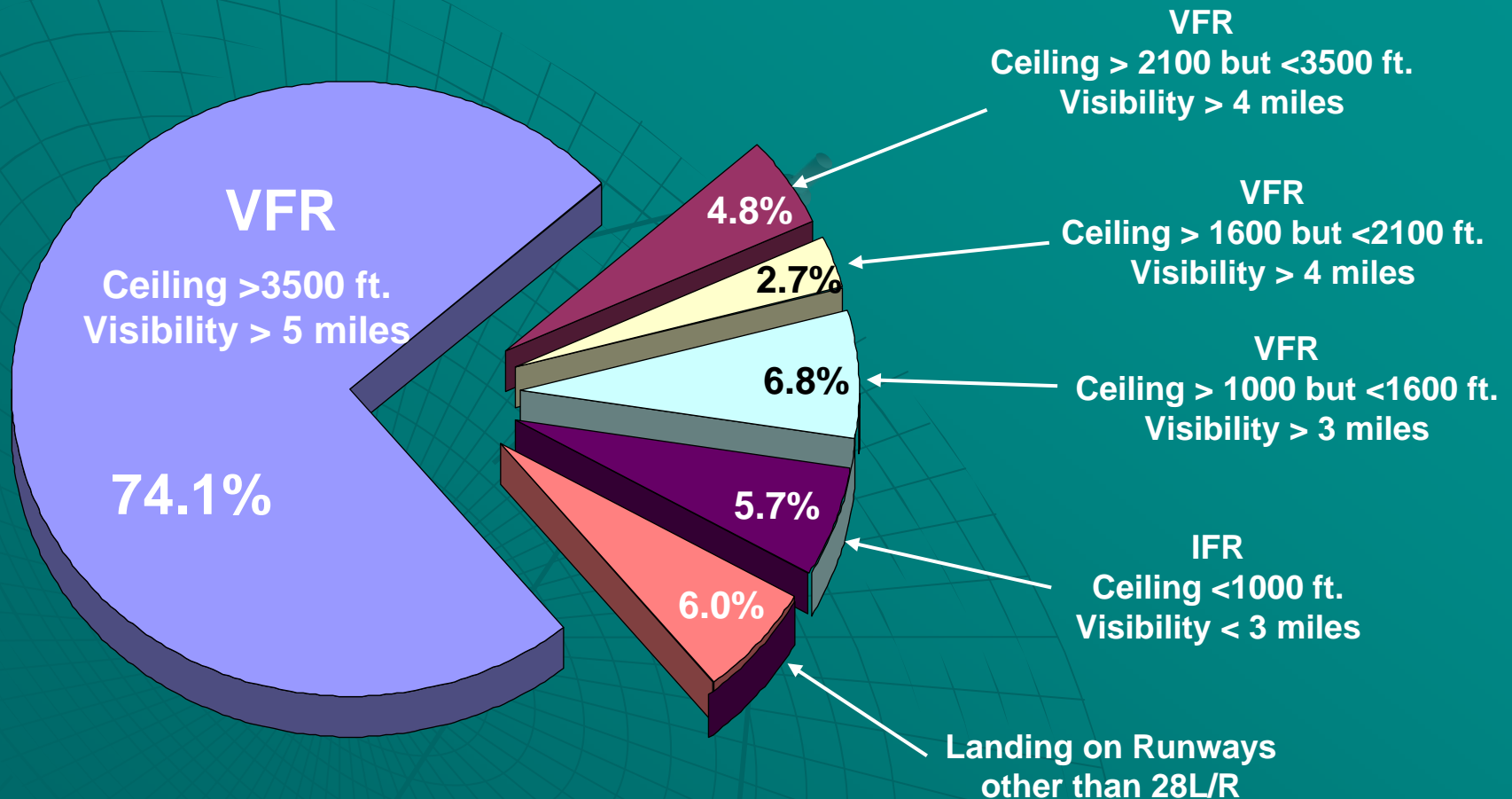
# Arrival Runway Usage at SFO





# Landing Runways 28L/R

## Weather Criteria



# Preliminary Assessment of Technologies for Arrival Capacity Enhancements at SFIA

94% of SFIA traffic lands to the west (runways 28L and/or 28R)

- VFR (Ceiling >3500ft) – 74.1%\*
  - ◆ Side-by-side arrivals using Visual Separations
- VFR Stratus 1 (Ceiling >2100 and <3500) – 4.8%\*
  - ◆ Side-by-side arrivals using SOIA/PRM
- VFR Stratus 2 (Ceiling >1600 and <2100) – 2.7%\*
  - ◆ Currently - In-trail to single runway
  - ◆ Immediate Solution - SOIA/PRM with Procedural Changes
  - ◆ Near-term Solution (2 to 3 years) - SOIA/PRM with Overlay Wake Turbulence "Box"
- VFR In-Trail (Ceiling >1000 and <1600) – 6.8%\*
  - ◆ Currently - In-trail to single runway
  - ◆ ASD-B, WakeVAS, CDTI/CAVS (down to VFR minimums of 1,000 foot ceilings)
- IFR In-Trail (Ceiling <1000) – 5.7%\*

\* 1989 – 2004 Weather Data, Source: NCDC and SFIA



Comments/Questions